



Photolysis frequency measurements aboard Zeppelin NT during PEGASOS 2012/13

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Airborne measurements of the solar spectral actinic flux densities for the determination of photolysis frequencies in the atmosphere were performed as part of the Pan-European Gas-AeroSOIs-climate interaction Study (PEGASOS). We present the instrumentation and characterisation of the spectroradiometer systems operated aboard the Zeppelin NT airship and photolysis frequency data obtained in field campaigns in 2012 and 2013.

Separate measurements of the upwelling and downwelling components of the actinic flux densities were performed with two instruments covering together a 4π -sr field of view. Since deviations from the ideal 2π -sr angular response of each actinic flux receiver can lead to over- or underestimations of the measured photolysis frequencies, detailed angular sensitivities of the two optical receivers were determined in the laboratory. The influence of the non-ideal behaviour on the photolysis frequency measurements was investigated using radiative transfer calculations of atmospheric radiance distributions under various atmospheric conditions and different ground albedos. Corresponding correction factors were derived. This method is also applicable for other research aircraft operating at higher altitudes.

Measurements of the solar actinic flux densities were performed in the wavelength range from 280 - 650 nm with a spectral resolution of about 2 nm and averaged over 3 s. An overview is shown of photolysis frequency data (O_3 , HNO_3 , HCHO , H_2O_2 , HNO_2 , NO_2 and NO_3) obtained in the atmospheric boundary layer during the PEGASOS campaigns in the Netherlands, Italy 2012 and Finland 2013. Dependencies of photolysis frequencies on cloud cover, flight altitude and wavelength range of the photolysis process are investigated as well as their influence on the photochemical processing of trace gases. Moreover the instrumentation allows for estimations of height depending spectral albedos.

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